LECTURE 1: Getting Started

- Welcome
- Lab and class orientation
- Overview of course and schedule
- The Contest
- What’s in your kit
- Assignment 1 handed out
- Kit distribution
Who We Are

• 7 Organizers prepare contest all year
• 7 TAs help during IAP
• We are students who have taken 6.270
• Each team assigned to one Organizer and TA
• Introductions will be made at the end, with kit distribution
Communication

• Mail
• Web
• Best way: talk to staff in lab
Lab

• Lab Hours:
  - Weekdays: 9 am – 11:45 pm
  - Weekends: noon – 10 pm
  - Extended lab hours in last week, of course

• Cleanliness, etc… or else!
  - We will take away LEGO
  - And during the last week, please remember to take showers
Getting Credit

• 6 units general elective credit P/F, 6 EDP’s
• Decide if you want credit by the time you get assignment 1 checked off
  – Tell us your student ID number at assignment 1 checkoff
• Criteria for receiving credit:
  – Qualifying robot
  – Timely completion of all assignments
  – Robot web page, due at end of course – \textbf{NO EXTENSIONS!}
Overview of Course

• First week
  - Soldering
  - Basic LEGO structure and bracing
  - Programming the HandyBoard
  - Making motion—actuators and gearboxes
  - Using the RF data
  - Digital sensors (mechanical)
  - Build your first complete robot
Overview of Course

• Second week
  - Coding paradigms
  - Using unique LEGO pieces
  - Robot behavior
  - Analog sensors (color-sensing)
  - Shaft encoders
  - Servos
  - Begin building competition robot
Overview of Course

• Last two weeks
  – Build competition robot
  – Debug
  – Live in lab (willingly?)
Schedule – Lectures

• Lecture 1, January 3, Monday, 10 am
  - Welcome
  - Contest Description
  - Kit Distribution

• Optional Evening Lecture, January 4, Tuesday, 7 pm
  - Basic C syntax
  - Coding Paradigms

• Lecture 2, January 5, Wednesday, 10 am
  - Electronics
  - HandyBoard / Interactive IC

• Lecture 3, January 7, Friday, 10 am
  - Servos, Sensors, Shaft Encoders
  - Robot Behavior
  - Threads
Schedule – Workshops

• Seven workshops this year
• Can help you finish this week’s assignments
• Meet in various places
  – Third floor rooms
  – Sixth floor, 6.111 Lab
Schedule – Workshops

• Start at 1, 2, 7, 8 pm
• Workshop discussion and activity take one hour
• Limited space available, signups available in 6th floor lab by 6.270 office
Schedule – Workshops

• Signup TODAY!
• Monday, January 3, and Tuesday, January 4
• Workshop 1 – Basic Techniques of LEGO Assembly
  – Basic LEGO infrastructure
  – Review of basic LEGO pieces
• Workshop 2 – Motor Mounting and LEGO Gearboxes
  – Building a gearbox
  – Mounting motors onto your robot
  – Make a gearbox (Assignment 2)
Schedule – Workshops

• Signup after Wednesday’s lecture
• Wednesday, January 5, and Thursday, January 6
• Workshop 3 – Electronics Assembly
  – How to solder
  – Soldering RF receiver (Assignment 2)
• Workshop 4 – Code & Sensors I: Basic Control and Robot Skills
  – Programming the HB (Assignment 2)
Schedule – Workshops
(Next Week)

• Signup after Friday’s lecture
• Monday, January 10, and Tuesday, January 11
• Workshop 5 – Servos, Sensors, and Shaft Encoders
  - Using analog sensors
  - Servo – the other motor
  - Shaft encoding with breakbeam sensor
  - Accelerometers to detect tilt
• Workshop 6 – Advanced LEGO
  - Using the unique pieces
  - Interesting gadgets
• Workshop 7 – Code & Sensors II: Advanced Techniques
  - Open vs. closed loop control
  - Line following
Schedule – Deliverables

- Seven Assignments
  - Due Tuesday (1/4), Thursday (1/6), Friday (1/7), Tuesday (1/11), Friday (1/14), Tuesday (1/18), Friday (1/21)
  - Available online
- Web Page – Saturday, January 29, 11:59 pm
- A Qualifying Robot
- Tuesday, January 25 – Impounding, 5 pm
  - Assuming robot qualified
  - Opportunity for staff to make sure robots have no rules violations
  - No further work on robot may be completed at this point
  - **NO EXTENSIONS!**
Schedule – Contest Week

• Mock Contest (for the early birds)
  – Friday, January 21, 7 pm

• Contest, Qualifying and Seeding Rounds
  – Sunday, January 23, 10 am
  – You can lose and qualify!

• Contest, First and Second Rounds
  – Wednesday, January 26, 10 am

• Contest, Final Rounds
  – Wednesday, January 26, 6 pm

• Lab Cleanup
  – Thursday, January 27, 2 pm
  – One person-hour per team, like Parts Sorting – MANDATORY
The Contest...
A short time from now, in a galaxy very close by, the masses are in unrest.

The non-trademark-infringing Gedi Knights Council, droid masters, guardians of the free world, and practitioners of the ancient interlocking plastic brick arts, have suffered a huge loss. Their former leader, Chin-walakane-ra, better known as "Chuck", has transcended to a higher plane of existence, and no longer will be around to keep the masses in check. An election will be held to determine "Chuck's" replacement, for without a leader, the Gedi Knights will be powerless to stop the ever-growing threats of all-nighters in lab, freshman showering, and Red Sox fans.
2005: Attack of the Drones

May the torque be with you!
A Second Contest!

• We need a t-shirt design!
  - Family friendly (please)
  - Non-trademark infringing
• Submit entries by Monday, January 10, 5 pm
  - 4 color designs (no grayscale)
  - Winner gets fabulous prizes (LEGOs, shirts, etc.)
Contest Rules: The Fine Print

• Competition rounds
  - Qualifying rounds do not count for losses, but count for seeding
  - First and second rounds can lead to elimination before final rounds
  - Seeding based on past performance

• Electronics modifications are permitted
  - New driver circuitry, bigger battery packs, etc.
  - Must provide full schematics (and more) to 6.270 staff BEFORE modification, and they will be made public

• No more beacon
  - Information transmitted wirelessly to your robot during the competition
Contest Rules: The Fine Print

• Assignment extension policy
  – Assignments are due at the time given; if you need an extension, talk to us!
  – The first extension is free
  – Each extension after that counts as a loss
  – An extension is good until the next assignment’s due date (except the last assignment)
Contest Rules: The Fine Print

• At next lecture
  - Sensor points
  - $30 electronics rule

• Rules questions?
  - Any decisions on rules questions will be posted on the server

• For more information, see Course Notes, Chapter 2
Your Kit

- Valued at $1500
- Big thanks to our generous sponsors:
Your Kit
Your Kit

The Brain: Handy Board

• For Assignment 1, run through test suite to ensure original Handy Board is in working order
• Manual is not included, can get it from “Handouts” site or http://handyboard.com
Damaged Handy Board Policy

- After Assignment 1, we assume your Handy Board was good when you got it, and any malfunctions that happen thereafter we will assume were your fault.
- If anything breaks, it’s your problem—we can help debug, but we won’t guarantee anything.
- Most common reasons a Handy Board breaks down:
  - Doubling up motor ports
  - Plugging things in backwards
  - Shorting things
Your Kit

Expansion Board for the HB

• Must be soldered for Assignment 2
• Don’t put on Handy Board yet
  − A hack needs to be made
  − We will tell you how to alter the Handy Board for the expansion board upon completion of Assignment 2
• Will be handed out Tuesday
Your Kit

The Juice: Hawker Batteries

- Three batteries soldered in series (6V)
- Be careful when soldering—they come charged
  - Pro (not really) demo in Lecture 2
- Build them for assignment 4
- Will be handed out at the end of this week
Your Kit

Battery Recharger

- Must be soldered for Assignment 4
- Four ports for the two battery packs
- Two speeds of recharge: fast and slow
  - Recharging on slow is not dangerous
  - Monitor charger if on fast charge (4 hours max)
- Will be handed out at the end of this week
Your Kit

The Muscles: Motors

- Two kinds of actuators allowed in 6.270: DC motors and servos
- Need to “LEGOize” these devices – go to workshop 3
- Can use glue or tape to mount them
- Allowed to alter LEGO for mounting
The Sensors

• Digital
  - Switches
  - Shaft encoders

• Analog
  - Phototransistors
  - Potentiometers
  - Gyroscope

• More to come in Lecture 2
The RF Receiver

Your Kit

- Assemble for assignment 2
- Lets us give you information during the competition round
  - Voting
  - Position
  - Start/end of match
Your Kit

The Infrastructure: LEGO

- Plates: structural reinforcement and spacing
- Flat Plates, smooth surfaces for sliding mechanisms or for sensor and motor mounting
Your Kit

LEGO Dimensions and Bracing

- Bracing makes structures stronger
- 3 plates = 1 beam
- 2 beams + 2 plates = 3 holes
- Pythagoras works, too
- Count number of nubs between holes
- Any other combination could add unnecessary shear forces
Your Kit

LEGO Dimensions and Bracing

- Bracing makes structures stronger
- 3 plates = 1 beam
- 2 beams + 2 plates = 3 holes
- Pythagoras works, too
- Count number of nubs between holes
- Any other combination could add unnecessary shear forces
Your Kit

Connectors

- Friction peg – creates structural support between beams; stiff
- Frictionless peg – allow angular movement
- ¾ pin – joint two 1-FLU liftarms; create flat surfaces for shafts
- ½ pin (with stud) – join two 1-FLU liftarms
- Axle with stud – can create lateral movement with a stop instead of a ½ bush
- Long friction peg – join three beams together conveniently
- Long frictionless peg – rotate arm that is structurally stronger
- Long friction peg with bush – connect beams from the outside
- Technic axle pin – extending axles out of beams, combining various connectors
- Pin with towball – attach rubber bands, ball and socket
- Axle with towball – attach rubber bands, ball and socket (no friction)
Your Kit

Treads

- Chains are same thickness as gears
- Treads are wider; use for tank models
- Some have tried to make conveyor belts—clever, but impractical
Your Kit

Tires

- The wheel is the final gear in your gearbox
- You can use tape or rubber bands on tires to alter coefficient of friction
- Tires are not always for locomotion—use to draw in or throw out objects
- Your robot will be heavy! Test your robots and wheels with full weight (batteries, HB, game objects)
Your Kit

What’s *Not* in Your Kit

- Heat Shrink
- Ribbon Cable
- Tools (tool store)
- Extra sensors, servos, motors
- Some stuff that we’ll be giving you soon
  - Expansion board kit
  - Batteries and charger kit
  - RF receiver kit
Your Kit

At this point, don’t touch:

• The distance sensor (we will talk about it Lecture 3)
Assignment 1

- Due Tuesday night (TOMORROW!) at 11:30 pm
- Five tasks to complete:
  1. Read directions carefully!
  2. Know your Organizer and TA
  3. Test the Handy Board
  4. Make the front-end loader
  5. Discuss rules and strategy
What’s Next

• Distribution
  – Kits
  – Handy Board
  – Pick up Assignment 1
• Go to the sixth floor lab and sign up for workshops beginning today
• Open up your kit and make sure you have everything (go to server to kit contents)
What’s Next

- Get to work on Assignment 1 (due tomorrow)
- Workshops available:
  - Workshop 1 – Basic Techniques of LEGO Assembly
    - Basic LEGO infrastructure
    - Review of basic LEGO pieces
  - Workshop 2 – Motor Mounting and LEGO Gearboxes
    - Building a gearbox
    - Mounting motors onto your robot
    - Make a gearbox (Assignment 2)
- Don’t forget to sign up in the 6th floor lab
Come Pick Up Your Kits!

- Teams 1-8
- Organizer: Ross Glashan
- TA: Mike Lin
Come Pick Up Your Kits!

- Teams 9-16
- Organizer: Michael Thilmont
- TA: Cliff Frey
Come Pick Up Your Kits!

- Teams 17-24
- Organizer: Dave Wang
- TA: Roberto Ramirez
Come Pick Up Your Kits!

- Teams 25-32
- Organizer: Vimal Bhalodia
- TA: Shuang You
Come Pick Up Your Kits!

- Teams 33-40
- Organizer: Zane Tian
- TA: Mike Matczynski
Come Pick Up Your Kits!

- Teams 41-48
- Organizer: Brett
- TA: Jim Roewe
Come Pick Up Your Kits!

- Teams 49-56
- Organizer: David Ziegler
- TA: Jonathan Wang
Why are you still here?
GO TO LAB!!